E/CONF.39/A/374
14 Nov.1962
ORIGINAL : ENGLISH

UNITED NATIONS CONFERENCE
ON THE APPLICATION OF SCIENCE AND TECHNOLOGY
FOR THE BENEFIT OF THE LESS DEVELOPED AREAS

Agenda Item: A.5.2.1

Italy

OUTLINE DIRECTIONS FOR MINING EXPLORATION IN GEOLOGICALLY LITTLE KNOWN OR UNEXPLORED TERRITORIES, WITH SPECIAL REFERENCE TO THE IDENTIFICATION OF CINNABAR DEPOSITS

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Introduction

The growing importance with mineral ores - both traditional and new, such as uranium and niobium - are assuming in today's world has caused an improvement of exploration techniques which, in certain fields, such as hydrocarbons, have reached a really extraordinary degree of perfection. Consequently, many areas (not only in under-developed countries), which had been explored in the past with uncertain or negative results, often prove very rewarding when subjected to new and more accurate surveying techniques.

In consideration of these results, many under-developed countries conscious of the importance that mining exploration may assume in a country's economic development in the improvement of its social conditions, are now trying to promote surveys of their territories.

OUTLINE METHODS AND CRITERIA OF A MODERN SURVEY PROJECT

Before a large company undertakes a survey, which must necessarily be carried out on a wide scale, it must be ascertained that in the territory to be explored there is a possibility to find rich deposits. Therefore, the main goal of exploration is the identification of those areas where theoretic considerations and/or empirical rules valid the world over lead to believe that there may be hidden deposits. The survey may be rationally planned as follows:

a) 1st phase. Knowledge of geological, morphologic, geographic, topographic features of the area, and sketching of an outline basic geological map.

In this phase, the aerial survey and geological photo-interpretation of the area have acquired an increasing importance. This study may be committed to specialized companies or may often with higher profits, be carried out by the surveying company itself, together with the initial exploration and geognostic sampling of outcropping information. The outline geological map thus obtained, even though incomplete, can already be sufficient to give some data on the nature and distribution of rock formations, which is the basis of the regional geophysical work that should come next, and for a first selection of the areas which appear to have the highest possibilities of giving good results.

b) IInd phase. Regional geophysical surveying: as soon as there is a general outline of the areas's geology, even if largely incomplete, it is opportune to start geophysical surveys. These surveys are aimed at completing the general surface geological survey with the determination of local structural characteristics, and to lead the surveying parties to restrict their interest to the areas where geological indications and anomalies in the geophysical behaviour make it seem possible that there may be mineral deposits. To this purpose, measurements (even if not too close) of gravimetry, geomagnetics, induction geoelectricity and radioactivity may be very useful. Such measurements may be carried out also from the air, which saves much time and work. The results, expressed as anomalous local variations of regional characteristics, supply valuable information in the zones where the future works shall be concentrated.

c) IIIrd phase. Direct exploration of interesting areas. This phase is characterized by beginning of real field work, which implies intense geological work on a local scale and the organization of base-camps for the field parties, of supplying and communications, of collecting and forwarding samples, and of their study, which, according to the circumstances, may be carried out at the company's headquarters or in field laboratories.

Since the work to be carried out is very important, it must be prearranged in its general outlines, so that an adequate distribution of duties may be achieved. The work of the field parties consists at first in the reconnaissance of the interesting areas, followed by systematic surveys and, finally, by detailed surveys which may be, according to the circumstances, geological, geochemical, geobotanical, or detailed geophysical surveys. In this way, all kinds of data will be collected, and the general outline and basic geological map will thus be completed.

Moreover, all surface indications that may eventually lead to the discovery of an ore body will be examined and inventoried; to this purpose, an efficient functioning of the central laboratory is necessary. There, a permanent staff, not encumbered by field duties, will make it possible to achieve the best coordination of field activity and to study thoroughly all the collected data.

d) IVth phase. Assessment of possible deposits and abandonment of useless areas. At this point, bore-holes begin to be used. Their function shall be, successively, to explore interesting areas, in order to ascertain the value and the size of ore-bodies which may be found so as to orientate future underground work or to explain anomalies which may not be explained in any other way. At the same time, the basic criteria to be applied in the decision of the zones to consider uninteresting and to be discarded shall be defined.

OUTLINE CRITERIA TO BE FOLLOWED IN THE RESEARCH OF CINNABAR BODIES

The above general considerations for exploration programmes hold true, of course, also for the exploration of cinnabar deposits. However, for these particular bodies, it will be opportune to take into consideration a few empirical rules, drawn from a comparative study of a large number of mercury mines in the world.

As is the case for other metals, mercury deposits also show a tendency to arrange themselves in continental metal provinces, within which they may break up into smaller units as districts, regions, belts, etc., connected to the final or late phases of tertiary orogenesis. Almost all the deposits are arranged in belts at the edge of blocks or near the orogenic insertion zone. They are very seldom found in basins. There is a relationship with late volcanic phenomena such as exhalation of gas and steam, or thermal waters. Instead, mercury does not seem to be linked to active volcanoes.

The most common structural character, to which a mineralization is connected, is the fault, both single and in systems, or any other structural discontinuity, such as contacts between plates or rigid tables and plastic or almost plastic, rocks. The formation in which valuable deposits are more frequently found are, in order of importance, sediments (among which are limestones and sandstones) metamorphic rocks, vulcanites and their tuffs. The chemistry of surrounding rocks seems to have little importance, since mercury may be found in any kind of rock.

The mineralogical characters most typical of mercury deposits are the almost constant presence of cinnabar as the predominant ore, and its association, often typical, with other metallic and gangue ores.

The attached table shows such characteristics with regard to the usual size of the various types of deposit.

TABLE 1. - TYPES OF MERCURY DEPOSITS, AND ASSOCIATED MINERALS

According to the Bailey and Phoenix 1944 classification, arranged according to decreasing productive capacity

		Associated Minerals		
		Pyrite and/or Marcasite	Clay Minerals	Stibnite
1. Sedimentary alternations	Calcite, Baryte Quartz	Sometimes present	Rare	Little
2. Limestone	Carbonates	Sometimes present	Sometimes present	Abundant
3. Volcanic	Frequent gypsum ± small amounts of calcite - quartz	Abundant	Abundant	Absent
4. Diabase dykes	calcite - silica	Abundant	Abundant	Absent
5. Metamorphic	quartz - baryte	Sometimes present	Few	little
6. Opalite	opal + alunite	Absent	Frequent	Absent
7. Granite	quartz-baryte	Sometimes present	Few	?
8. Sulphurous	abundant sulphur + chalcedony - quartz	Sometimes present	Few	?

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